THE LIVABLE CITY:

Dr. Abel Wolman and the Continuing Work of the Engineer

Since the 1880s, the sanitary engineer and public health practitioner have made significant contributions to create clean and livable cities. "A Court for King Cholera, 1852" ***The Bettmann Archive, Inc.***

The Livable City: Dr. Abel Wolman and the Continuing Work of the Engineer

Excerpts from this exhibition at the Baltimore Public Works Museum
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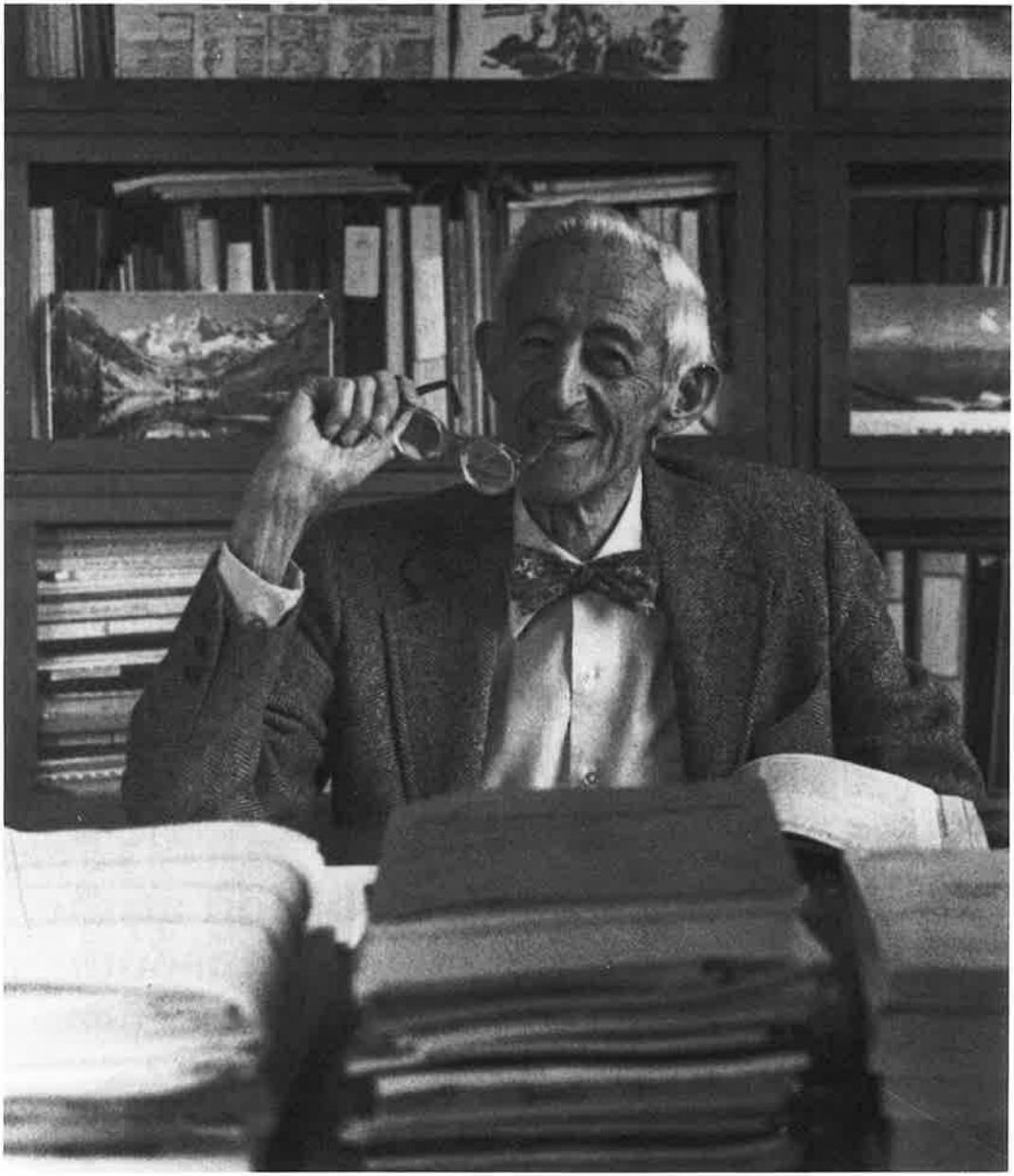
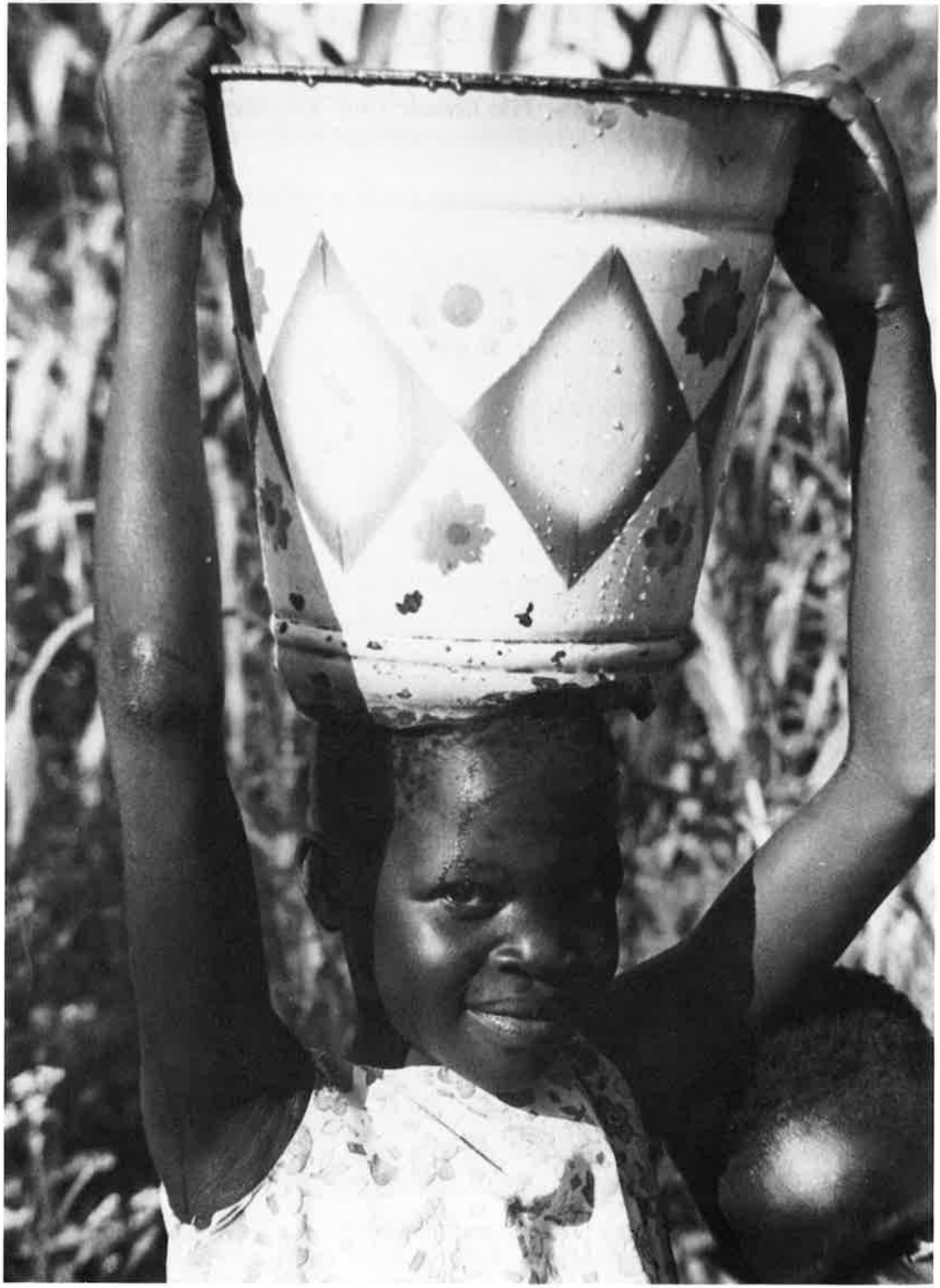


Abel Wolman: sanitary engineer, educator, consultant and lecturer, dubbed "friend of the thirsty" by the *New York Times*. *Photo courtesy of Bill Denison.*

Prologue

Since its inception, the exhibit "The Livable City: Dr. Abel Wolman and the Continuing Work of the Engineer" went through many twists and turns of ideas and their refinement. This project first began as an exhibition about the history of public health in Baltimore with a portion of the exhibition dedicated to the work of Dr. Abel Wolman. As research progressed, we found that dedicating a portion of the exhibit to Dr. Wolman's vast career was physically impossible in our small museum. The exhibit then began to focus solely on the career of Abel Wolman. After all, it only seemed fitting that the man whose name is synonomous with the engineering profession should be the topic of an exhibition. As ideas were refined, it became clear that Dr. Wolman's contributions were especially significant in terms of their historical context. To truly appreciate Dr. Wolman's work, there must be a clear understanding of city life and the state of engineering technology prior to the beginning of his career in 1915. From these many ideas was born "The Livable City: Dr. Abel Wolman and the Continuing Work of the Engineer." This exhibit portrays the dramatic story of the engineer's designs for a healthy, livable city. The final project combines all those elements of the earlier exhibit ideas. Public health, engineering and Abel Wolman are the basic ingredients of the development of the modern city.

The spirit and cooperation the Museum experienced in putting together this exhibition is a true testament to the esteem given to Dr. Wolman by his peers. The mention of Dr. Wolman's name brought forth an outpouring of interest, advice and materials—enough to produce an exhibit five times larger than the space at the Public Works Museum permits. To those who know Dr. Wolman, his name conjures descriptions of his adroitness, skill, eloquence, genius and wit. Dr. Abel Wolman is truly a rare man who has transcended political and social boundaries to make the world a more livable place.



Water is a basic human necessity. Its availability and quality are major factors that determine how we live. ***UNICEF photo courtesy of William Campbell.***

"One may wonder why it is necessary and desirable to rehearse, in the middle of the twentieth century, the virtues and necessities of community water service. Armies have fought over water, people have died from it, and civilizations have dwindled after losing it, health workers have blessed it and monarchs and priests have worshipped it."

Abel Wolman, *WHO Document A 17 Technical Discussions/4, March 6, 1964.*

For lack of technology and an understanding of the relationship between health and sanitation, America's rivers and streams were simultaneously used as sources for drinking water and the disposal of wastes during much of the nineteenth century. Household wastes often contaminated the groundwater that seeped into the rivers and streams which served as sources of drinking water. "Disposing of House Slops," ***The Bettmann Archive, Inc.***

INTRODUCTION
Water, Sanitation, the Engineer and the Livable City

Water is a basic human necessity. Its availability and quality are major factors that determine how we live. Life is made more livable when we have an ample supply of clean, healthy water. At the same time, untreated water is a potential threat to our health. Untreated, it can be a carrier of waterborne bacteria that cause illness, disease and even death. Providing adequate supplies of clean, drinkable water is the job of the sanitary engineer. Sanitary engineering is a profession that combines the medical knowledge of the public health practitioner and the technological know-how of the engineer. These skills are used together to build water and waste disposal systems to control the factors that threaten our health and well-being.

Today we know that the environment plays an important role in determining the health of people. But it was not until the latter part of the nineteenth century when scientific findings proved the definite link between a person's health and his environment. This new knowledge spurred the medical and engineering professions into activities that created healthier, cleaner cities. The new goal was to *prevent* water-related diseases before they struck.

During the past one hundred years, our lives have been dramatically changed by the work of the sanitary engineer. It has only been within the last sixty years that our lives have not been touched by the contagious and often fatal waterborne diseases of yellow fever, cholera and typhoid fever. The management of sanitary conditions has proved to be essential to the development of city life.

Dubbed "friend of the thirsty" by the *New York Times,* Abel Wolman, Professor Emeritus of Sanitary Engineering at The Johns Hopkins University, is one of the world's leading sanitary engineers. During his seventy-plus year career, Dr. Wolman has made contributions that have revolutionized the way people live throughout the world. As an engineer, consultant, educator and prolific writer, Abel Wolman has defined the development of the engineering profession. Most notably, Dr. Wolman has been at the forefront of emphasizing the public health aspects of engineering. Through his foresight and engineering expertise, Dr. Wolman has established standards for planning for the future needs of people around the world. Dr. Wolman's work has been an affirmation of the vitality of city life. In every professional capacity, Dr. Wolman has been guided by a philosophy which considers the health and well-being of people as his primary concern.

Throughout the nineteenth century, a vast array of gimmicks and magic potions were offered as protection against water-related diseases such as cholera and typhoid fever. "Cholera Prevention Suit," *The Bettmann Archive, Inc.*

Water for the People

America's first towns were established near accessible water sources. Water was essential to the economic, commercial and social growth of the early American towns. The major means of transportation were waterways. The development of harbors determined the prestige of the cities of New York, Boston and Baltimore. Ample water was also a necessity for fire fighting to protect commercial interests. A daily supply of water was essential for cooking and bathing. Proximity to a nearby stream or spring was important since the means of conveyance was most often a leather bucket.

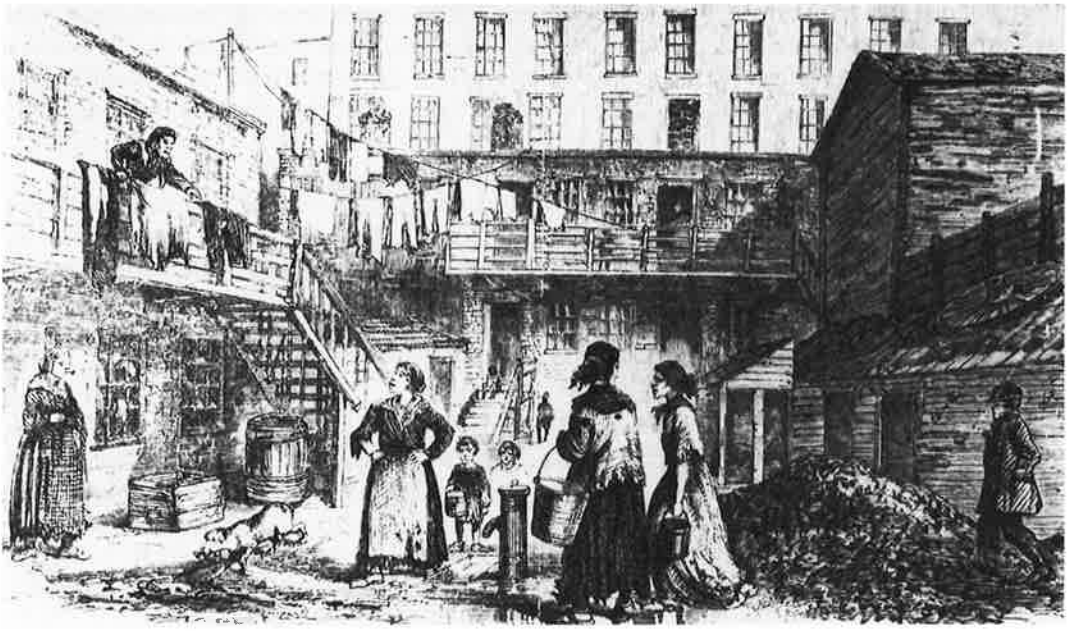
As populations grew, the need for an organized water supply system became apparent. The first water companies were organized by private businessmen who profited by the subscriptions sold to their water customers. Revenues from the companies were used to lay wooden and clay pipes that conveyed water from a source to a nearby street pump. For those who could not afford to subscribe to a water system, hauling water from a spring, stream or well remained the only way to obtain it.

Very often, water supplies and waste disposal sources were one and the same. For much of the nineteenth century, Americans relied upon cesspools and privies to dispose of their wastes. Both of these means of disposal were simply holes dug in the ground for sewage and household wastes. This was done on an unregulated, individual basis. Fouled groundwater from overflowing privies and cesspools contaminated drinking water supplies, creating serious health problems.

Throughout the early 1800s, outbreaks of waterborne diseases such as yellow fever and cholera struck American cities. Medical beliefs of the day attributed such epidemics to the victims' moral character. The majority of the victims were from the working classes who lived in the most congested sections of cities. Quarantining the afflicted was the only medical solution available then. There were no cures. Quarantine proved to be an ineffective means of controlling waterborne illnesses.

Industrialization increased the existing health and sanitation problems in American cities. Beginning in the 1860s, the Industrial Revolution attracted people into the cities from rural communities as well as immigrants from European countries. The seven-fold increase in urban population from 6.2 million in 1860 to 44.6 million in 1910 created tremendous strains on water supplies, waste disposal methods and housing. Industrial wastes created additonal problems for America's water sources. Wastes such as dyes and fats from tanneries and slaughterhouses were directly dumped into open waterways, causing unsightly pollution as well as foul-smelling odors.

The problems of a growing America could not be managed without the participation of local governments. Increasingly, local governments began to assume the responsibilities held by private water companies. City funds were allocated to expand the existing water systems to include all of the people living in cities. The accelerated rate of growth of the cities called attention to the need for a plan of action for their continued development. The concepts of *planning* and *resource allocation* were to become crucial to the successful development of modern American cities.



Industrialization and the associated growth of cities and populations increased the problems of supplying adequate water and waste disposal systems. Progress in the fields of science, medicine and technology aided sanitary engineers in their efforts to build sewage systems. "Community water pump in a New York City tenement courtyard," *The Bettmann Archive, Inc.*

The Advent of Sanitary Engineering: Engineering the Health of the City

The period between 1875 and 1925 marks the beginning of the sanitary engineering profession in America. Two major factors spurred the development of the profession. The growth of America's cities and the need for additional water supplies and improved waste disposal systems demanded solutions. The scientific findings that proved the link between a person's health and his environment provided the solutions. The sanitary engineering profession was different from the civil engineering profession. Until the 1870s, civil engineers focused on the physical methods of constructing water and waste disposal systems. In contrast, the sanitary engineer, trained with an understanding of the transmission of diseases, focused on the environmental factors of building water and waste disposal facilities. Sanitary engineers were concerned with the treatment and quality of water and its effects on the health of people.

Filtration was the first successful means of removing bacteria from water supply systems. The first filtration designs known as the "slow sand" filtration method was developed by James P. Kirkwood in Poughkeepsie, New York in 1872. In America, the first successful filtration project was accomplished at the Lawrence Experiment Station in Massachusetts in 1887.

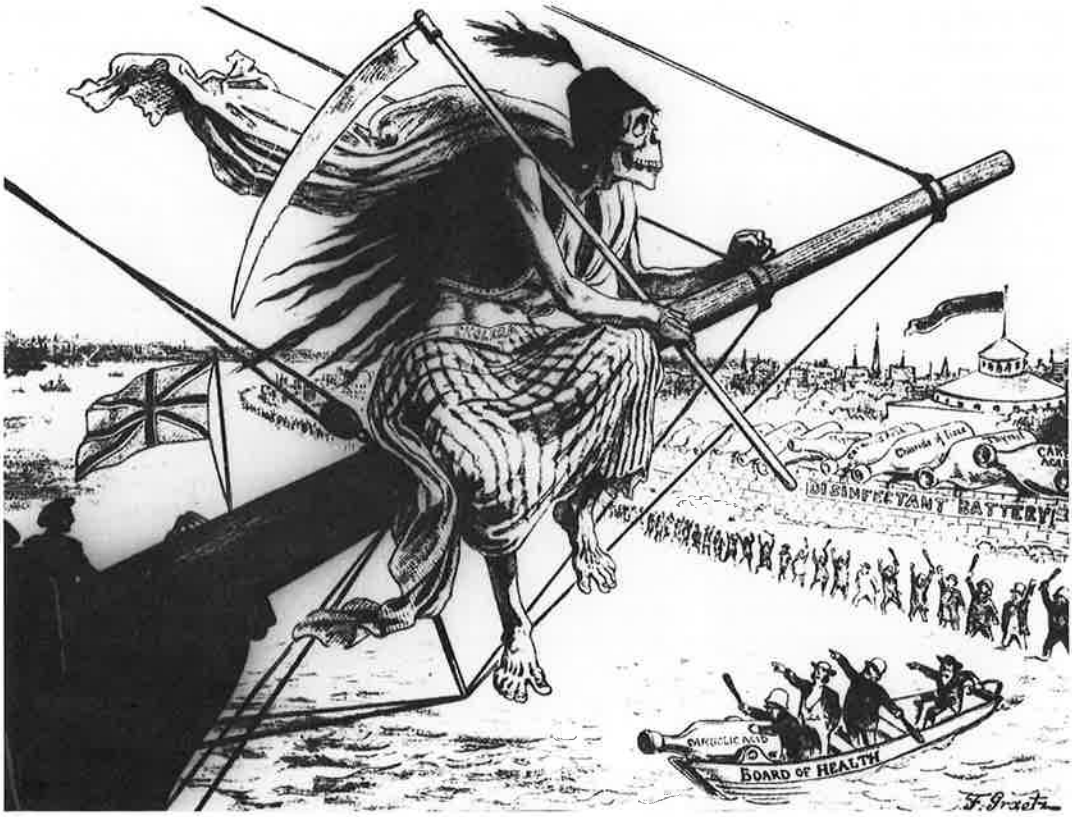
The Sanitary Reform Movement: Public Health and Community Action

The prevention of disease was the most important concept in the medical field during the nineteenth century. Preventive medicine or public health is based upon community action in the protection of the health of the individual. The public health movement of the nineteenth century included a partnership among physicians, engineers and civic leaders. The development of the sanitary engineering profession was a prerequisite for improving public health.

The combined knowledge of public health practitioners and sanitary engineers served as the basis for the sanitary reform movement in America. Across the country, campaigns were started to promote the benefits of *preventive* health care. These campaigns focused on the promotion of cleaner streets and better housing conditions. People were encouraged to participate in the improvement of their homes and sanitary practices. Legislation was formed to condemn the construction of outdoor privies and to enforce new housing and plumbing codes.

The campaign for improved physical surroundings extended to campaigns for improved personal care and hygiene. Magazine and newspaper advertisements promised better health through cleaner living.

As the work of the sanitary engineer progressed into the beginning of the twentieth century, America's cities were becoming better organized and more livable. The engineering profession was essential to the adaptation of new housing standards and better systems for water and waste disposal. The contribution of the engineering profession was most evident in the area of public health where the typhoid death rate dropped from 36 per 100,000 people in 1900 to 0.1 per 100,000 people in 1950. The engineer had succeeded in making the city a more livable place.



Significant improvements in public health measures began in the 1880s. The establishment of state Boards of Health and legislation that prohibited the construction of new privies aided the public health practitioner in his job to improve the sanitary conditions in America's cities. "The kind of 'Assisted Emigrant' we cannot afford to Admit," ***The Bettmann Archive, Inc.***

Dr. Abel Wolman: The Baltimore Connection

Baltimore has been an important link in the development of the sanitary engineering and public health professions. Many of the city's contributions can be credited to the work of Dr. Abel Wolman. Abel Wolman was born in Baltimore on June 10, 1892, the fourth of six children of Polish-Jewish immigrants, Morris and Rosa Wolman. As a young man, Abel Wolman grew up in East Baltimore, graduating high school at City College in 1909. Wolman remained in Baltimore to attend college at The Johns Hopkins University, graduating in 1913 with a Bachelor of Arts degree. In the fall of 1913 Wolman returned to Johns Hopkins as one of four students in the first class of the newly established School of Engineering. In 1915 Wolman graduated with a Bachelor of Science in Engineering. In 1919 Abel Wolman married the former Anne Gordon. Together they had one child, M. Gordon "Reds" Wolman. "Reds" Wolman holds the unusual distinction of following in his father's position as the Chairman of the Department of Environmental Engineering and Geography at the Johns Hopkins University.

When he was a young man, Abel Wolman recalls there being a piece of cheesecloth tied around the spigot in his family's home to filter out the stones and dirt that flowed through the faucet. Some eighty years later, Abel Wolman stands as an international statesman for the sanitary engineering profession. Within the course of his career, the engineering profession has matured, due to a great degree to the work of Abel Wolman.

During his very remarkable career, Dr. Wolman has held no less than 230 positions in the fields of public works, engineering, public health and education. A prolific writer, Dr. Wolman has published four books and over 300 professional articles. Abel Wolman has been involved in, if not directly responsible for, the implementation of projects at the local, state, national and international levels of government. His engineering talents have led to such varied jobs as collecting water samples of the Potomac River for the U.S. Public Health Service in 1913, to the position of Director of the Federal Public Works Administration for Maryland and Delaware in the 1930s to Chairman of the Stack Gas Working Group—General Waste Problems of the Atomic Energy Commission from 1947 to 1960.

The entire world has been Abel Wolman's professional arena, with the first of many foreign assignments beginning in 1928 as a member of the Reference Board of Medical and Public Health for Hadassah for Palestine. Since then, Abel Wolman has become well-known for his work in improving the sanitary conditions and providing quality drinking water in countries throughout the world. Among the most significant of his contributions is Dr. Wolman's participation in the World Health Organization which was founded in Geneva in 1948. As a member of the U.S. delegation, Dr. Wolman was instrumental in creating the environmental unit of the World Health Organization. The goal of this unit was to provide the very basics of safe water supplies and the removal of human wastes from man's direct surroundings. By this action, the role of the sanitary engineer became linked to the public health aspects of building more livable places in lesser developed countries. Today, Abel Wolman's goal of improved sanitary conditions is crucial to the work of the World Health Organization.

The sanitary engineer, trained with an understanding of the transmission of diseases, was concerned with the quality of water. Healthier people and more livable cities resulted from the work of the twentieth century engineer. Photo from the collection of the *Baltimore Public Works Museum.*

"I do have faith—or should I put it the other way around—I have a responsibility *to mankind. To some that may strike a chord of suspicion, but I do have it; otherwise I don't believe I'd be in the game in which I am, as I may have mentioned before. Secondly, if I entered it, I don't know that I would have continued in it—but I do. I still have the feeling of responsibility to mankind. Why, I don't know—partly heritage, partly environment, partly (maybe) even intellectual decision."*

Abel Wolman to Walter J. Hollander, Jr., M.D., in *Abel Wolman, His Life and Philosophy. An Oral History, 1981.*

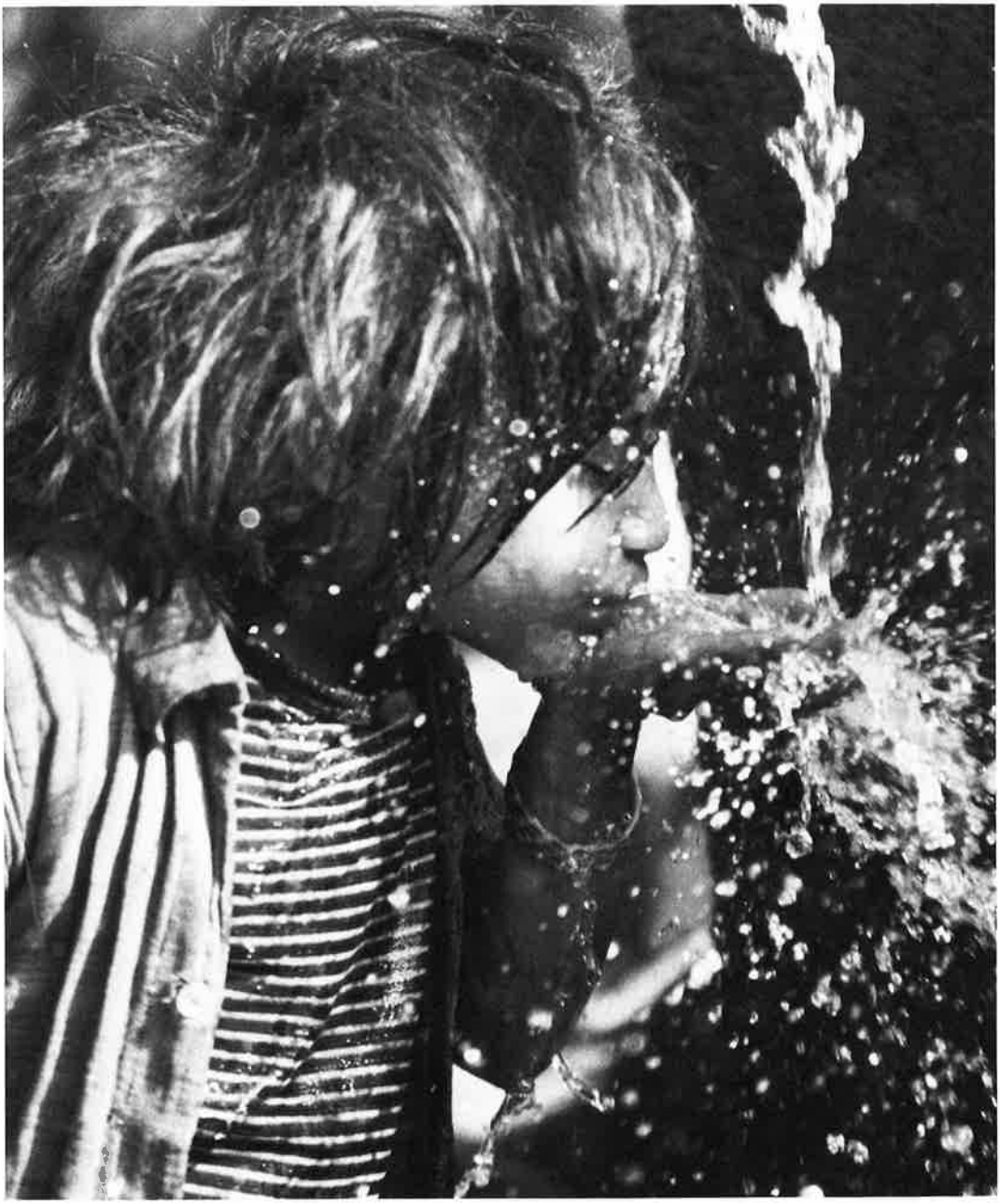
The Johns Hopkins Education: The Link Between Engineering and Public Health

The Johns Hopkins University and School of Hygiene and Public Health are two institutions that have educated generations of engineers and public health practitioners who work to make the world a more livable place. The basic relationship between one's health and the condition of one's environment is the basis for programs in both fields. This seemingly simple link was no easy task to accomplish. The success of this hybrid instruction can be credited to Dr. Abel Wolman. In an unprecedented move, Dr. Wolman served as Chairman of both The Johns Hopkins University School of Engineering and School of Hygiene and Public Health from 1937 to 1962. During those 25 years, Professor Wolman commuted between the two campuses, instructing an international collection of undergraduate and graduate students in the underlying principles of sanitary engineering, its universal relationship to health and its practical application to society. In addition to his Hopkins position, Dr. Wolman served as a lecturer on the faculties of Harvard University, Princeton University, University of Chicago and the University of Southern California.

The Pioneer Years: Standardized Chlorination of Water Supplies

Abel Wolman is best known for his work in the standardized application of chlorine-treated water. Chlorination is a method of disinfecting water supplies of harmful bacteria. Experiments in chlorination began in the 1880s. It was not until 1908 when it was first used in America. At that time, random doses of chlorine were applied to water. The same dose that was appropriate for one location could prove to be too weak for another source and offer no protection against harmful bacteria. The standardized use of chlorine was perfected in 1918 by Abel Wolman and Linn H. Enslow, a chemist, while they were working at the Maryland State Health Department. Together, Wolman and Enslow developed a controlled procedure for the chlorination of water. The key to their success was in establishing the absorption rate of chlorine in various waters. By so doing, they were able to arrive at a formula for treating water at filtration plants despite the original source and composition of the water. This treatment provided safe, drinkable water in all instances.

Eventually, chlorination became a national and international practice. Dr. Wolman's contribution is often cited as the single most important means of protecting against waterborne diseases throughout the world.



For all of the progress of the last one hundred years, much work remains to be done. In many parts of the world the threat of waterborne diseases is still a very real part of life. Supplying safe and adequate water is the continuing work of the engineer. *UNICEF photo by John Isaac.*

Much of the success of Abel Wolman can be attributed to his personal qualities that have earned him accolades of respect and admiration of his students, colleagues and associates. A genuine humanitarian concern has guided Abel Wolman throughout his career. His is a career which has improved the lives of literally millions of people around the world.

"Methodology" or a plan of action best characterizes Abel Wolman's work. This philosophy which considers the means or process as important as the ultimate goal, has distinguished Dr. Wolman as one of the first engineers to integrate the concept of the *planning process* as a standard of the engineering profession. His ability to translate technical issues into common language and to articulate the work of the engineer has placed Abel Wolman at the forefront of the global engineering and public health communities.

The Worldwide Network for Water and Sanitation

Today, many of the world's lesser developed countries are in similar water supply situations to those which faced America one hundred years ago. At the turn of the twentieth century, water-related diarrheal diseases killed young children in the United States at rates comparable to those of today in the developing world. In these countries, one child in four dies before his fifth birthday. An adequate and safe supply of water and improved sanitation are essential to better health and living conditions. The use of safe water for bathing and cooking significantly contributes to a person's health. Sanitation, especially adequate disposal of human wastes, is also essential to better health. The engineer fulfills the universal need for adequate water, proper waste disposal and improved health.

As an international statesman for the engineering profession, Abel Wolman has been at the forefront of the global effort to improve people's physical surroundings. As a consultant and educator, Dr. Wolman has trained two generations of engineers and public health practitioners in Latin America and Africa. Dr. Wolman's philosophy regarding the methodology of working with lesser developed countries has been translated into policies that guide the activities of such agencies as the World Health Organization, the Pan American Health Office, the Agency for International Development and the United Nations.

"The western policy and practice may or may not be valuable guides for underdeveloped countries. Close scrutiny for adaptation is obviously required. It is surprising, however, that long tested principles and practices evolved in the western world have been so often ignored by western workers, because they have erroneously assumed that such practices are culture-bound only to the United States. The lesson hitherto emphasized by some cultural anthropologists, that indigenous cultures should be respected and hence, untouched, has been too well learned by our exported western professional. As a matter of fact, almost every modern precept of public health activity requires a cultural change. Even the introduction of the lowly privy requires significant change in ancient habit and custom. In change, intelligently adjusted to the national soil, lies the future hope of real public health progress. Fortunately, experience teaches us that change does occur, with surprising rapidity of acceptance."

Abel Wolman to Walter J. Hollander, Jr., M.D., in *Abel Wolman, His Life and Philosophy. An Oral History, 1981.*

What About the Future for Engineers?

by Abel Wolman

Since biblical times, someone has always had a responsibility to satisfy multiple gods, to fight neighbors, to please kings, or just to survive. Whether he or she was called an engineer was not too important.

As we stand here today, trying as usual to have people become aware as to how they survive, work, play, fight, and deliberate, it is inevitable that we must think about the many tomorrows. If we have done so well by now, will the engineer be dispensed with by the 1990s? The answer, of course, is no, unless people disappear from this earth.

The future, whether bleak or fine, will have more people who will not only want, but must have, more and better services. Potable water quality will be more and more refined, as substances entering it become more complex and more threatening. Drinking water will be literally manufactured to meet more exquisite criteria.

Waste water management similarly will be elevated to scientific and technologic levels which might startle us today. Public demand will not be satisfied with processes which fall below aesthetic acceptance, disturb natural environments, are wasteful of energy, and which continue to move sludge contestably from nowhere to nowhere.

Polluters, private and public, will be pressed to recognize their responsibilities for their residual wastes. These must be reduced, recycled, and reused—and procedures for so doing will be developed at cost-effective levels.

History warns us that issues and challenges are never completely resolved. The sudden increase in parasite intrusion into potable water systems in Pennsylvania, Colorado and other states are simple reminders that we live on a thin crust of civilization. The parasite "*guardia**" is symbolic of the forgotten fact that all of us live in a "wormy world" against which the engineer has a continuing battle.

The U.S. may approach 300 million people by the year 2000. They will want all services to which their forebears have become accustomed. Water to drink; sewage to be handled; garbage to be processed; energy to be provided; transport to be facilitated (even into space); pollution to be stemmed; buildings to be destroyed, recovered, replaced; floods to be prevented or ameliorated; earthquakes to be challenged; droughts to be foreseen and provided for; even man to be replaced in many activities—this is the world of engineering to be! He will simply continue to be, what he has always been, an "instrument of civilization."

*Spanish for *policeman* or *guard*

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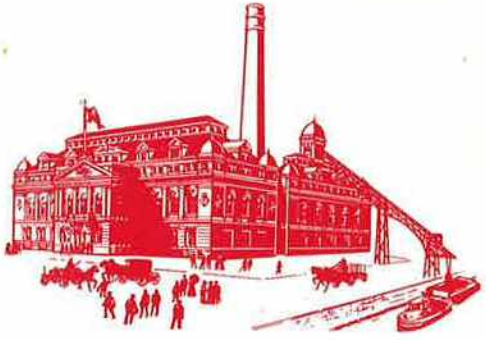

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